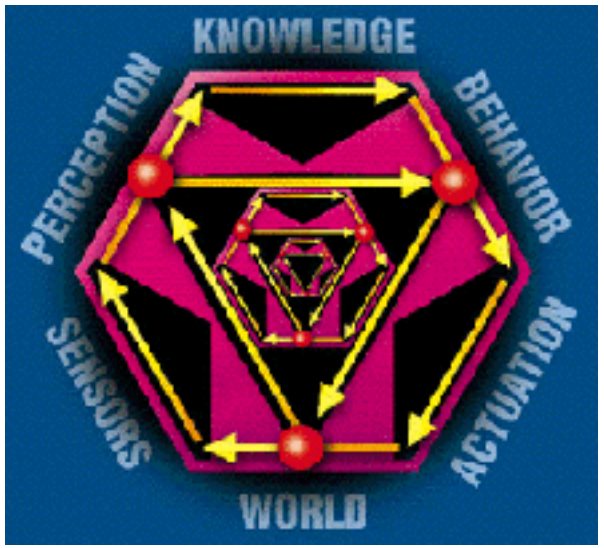
Advance Program and Announcement

INTELLIGENT SYSTEMS
and
SEMIOTICS:
A LEARNING PERSPECTIVE



September 22–25, 1997
Gaithersburg, Md., USA

Sponsored by:
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K. Pourrezaei - Drexel U., USA
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M. Sulcoski - NGIS, USA
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S. G. Tzafestas - NTUA, Greece
J. Umiker-Sebeok - Indiana U., USA
B. Turksen - U. of Toronto, Canada
J. C. A. van der Lubbe - Delft U. of Technology, The Netherlands
F.Y. Wang - U. of Arizona, USA
P. Wang - Duke U., USA
J. M. Weiss - EPRI, USA
P. Werbos - NSF, USA
F. Zhao - Ohio State U., USA

Conference Description

This conference is focused upon Learning Processes in Intelligent Systems. This is the fourth meeting dedicated to Applied Semiotics and its Application in Large and Complex Systems, including Intelligent Machines.

The first meeting "Architectures for Semiotic Modeling and Situation Analysis in Large Complex Systems," was conducted at Monterey in August 1995 in association with the 10th IEEE Symposium on Intelligent Control. The International Conference "Intelligent Systems: A Semiotic Perspective" gathered at NIST in October 1996. The Workshop on Semiotic Analysis and Design of Intelligent Systems (March 1997, Triangle Park, NC) can be considered an introduction to the conference described in this announcement.

This conference will discuss existing formal methodologies for dealing with:

- learning in large symbolic structures,
- systems of representation emerging from learning processes, and
- systems and machines that can benefit from learning intelligence.

New insights will be explored in the areas of modeling, reasoning, analysis, design, and application of intelligent systems. The role of semiotic methods in building learning architectures will be the central focus.

Plenary Speakers

Y. Kilmontovich, Moscow State University, Russia -- "Introduction in Quantum Theory of Open Systems" Y. Kilmontovich will demonstrate the domain where Semiotics and Physics become interwoven. The author of several textbooks in Statistical Physics and related domains, he will demonstrate how theoretical physics deals with problems of emergence and he will introduce us to a really multiresolutional picture of the World.

L. Fogel, Natural Selection -- "Optimizing Evolutionary Computation" In this lecture L. Fogel will describe the fundamentals of the principle of Evolutionary Computation as well as the details of the discovery and development of the methodology of Evolutionary Programming. In this talk, he will tell us about the experience of using this technique in Intelligent Systems. He will compare algorithms of evolutionary programming with algorithms of genetic search and demonstrate their different aspects within the general concept of evolution and natural selection.

Y. C. Ho, Harvard University -- "Ordinal Optimization: A Tool of Computational Intelligence" Intelligent Systems are very complex and typically they do not possess simple analytical structures similar to differential equation based physical systems. Stochastic effects abound in these systems, their computational processes involve search in a high parameter configuration and/or state space. While simulation is a tool of choice for the general purpose analysis of performance, as a tool of optimization, the computation should be often ruled out because of its complexity. In this talk, Y.C. Ho advocates a strategic redirection of the general optimization problem and demonstrates the results achieved and the problems remaining.

J. S. Albus, NIST -- "Why Now Semiotics? From Real Time Control to the Science of Signs and Symbols" NIST-RCS is a methodology for building intelligent systems based upon scientific premises which have been previously developed for continuous motion and discrete event control and uses models in terms of differential or difference equations. At each level of the multiresolutional hierarchy, discrete goals are decomposed into sequences of higher resolution tasks. Signals are filtered and grouped into entities which can be named and be included in a grammar and language. The process of grouping and naming gives rise to the emergence of signs and symbols. Clearly, the situation has matured to a level where the principle domain is linguistic and logical, the domain of signs
and symbols. The time has come to include Semiotics in the scope of NIST-RCS, and

to address the issue of signs and symbols. Signs and Symbols are products of the mind. Within the integrated NIST-RCS open system architecture for very large and complex, intelligent systems, we can see a model of mind looming.

Lofti A. Zadeh, University of California at Berkeley -- "The Centrality of Information Granulation in Human and Machine Intelligence" The following is an excerpt from the abstract: "In a general setting, granulation involves a partitioning of a real or mental objects into granules, with a granule being a clump of points (objects) drawn together by undistinguishability, similarity, proximity or functionality. Granulation is crisp or fuzzy depending on whether the granules are crisp or fuzzy. In the case of age, for example, the time-intervals {1, 2, 3, ... ,130} are crisp, whereas the fuzzy time-intervals {very young, young, middle-aged, old, very old} are not. ...In the final analysis, fuzzy information granulation is central to human reasoning and concept formation. It is this aspect of fuzzy IG that underlies its essential role in the conception and design of intelligent systems. What is conclusive is that there are many, many tasks which humans can perform with ease and that no machine could perform without the use of fuzzy information granulation, This conclusion has a thought-provoking implication for AI: Without the methodology of fuzzy IG in its armament, AI cannot achieve its goals."

A. M. Meystel, NIST/Drexel U. -- "Multiresolutional Matters of The Mind" A.M. Meystel will demonstrate how the classical issues of the interdependence between the World and its Representation are affected by a new science: the multiresolutional one. Are the levels of resolution just a matter of mind, or do they emerge no matter what? The answers affect both the ways we conduct scientific research and organize the processes of technological design.

What is "semiotics" after all?
Learning How To Know:
Semiotics and Multiscale Cybernetics

Intelligent systems acquire knowledge through preprogramming and learning. These processes deal with information represented in signs (labels, elementary codes) and symbols (generalizations of signs). The synapses of our nervous system generate signs and symbols, and are signs and symbols too. The formation and use of signs and symbols is analyzed within the discipline of *semiotics*. In semiotics, the central process under consideration is called *semiosis*. This process takes the form of an elementary signal processing loop which represents both *functioning* and *learning*. Semiosis is a combination of the following subprocesses:

a) encoding of the sensations (sets of signals from transducers interpretable as states of reality) by using elementary signs

b) associating encoded sensation with codes of actions (sets of phenomena which entail the commands generated by the system)

c) constructing strings of codes for "states-actions-..." **(S-A-S-A...)** stored in the memory

d) assigning to these strings of signs values of goodness **J** interpretable under specific goals **G**, which allow interpretation of "experiences**"**

E: [G,(S-A-...)]-->J

e) discovering classes of experiences **{E}**, assigning labels (signs, symbols) to them, assigning signs to their components (generation of the concepts of objects and actions)

f) forming hypotheses of new behavioral rules using previously stored results of prior processes of semiosis.

The loop of semiosis has a striking similarity with a cybernetic view of the system. The sequence "a" through "f" describes computational activities at a single level of granularity in a system for knowledge acquisition and utilization (e.g. "action"), i.e. in a *semiotic system*. It is typical for the analysis of a semiotic system to be focused upon the *meaning* of the system and the process: after answering the *What?* the semiotician attempts to answer the question, *Why?*

In cybernetics, the same elementary signal processing loop is a source of different insights. *How?* and *How to control?* are the typical questions for the cyberneticist . As a result, a semiotic system turns out to be equipped with the means of generating feedforward commands which contain the goals and tasks, and it becomes a conventional *cybernetic system*.

In other words, the cybernetic loop of system functioning is almost equivalent to the semiotic loop of semiosis with the following difference: the first describes control processes in physical terms while the second analyzes the processes in the sign-symbol domain. A more serious difference is in the emphasis: since semiotics is pursuing the meaning of the system, the goal is always questioned, and another loop should be discussed where the goal is just a variable. This new loop (a coarser granularity loop) has a different goal, and the goal of the first loop is just a variable for this new loop. The pursuit of meaning leads us to discovery of loops of different granularity. (Actually, emergence of the objects and processes of coarser granularity was ingrained in the stage "g" of the description of the process of learning.

When **m** levels of granularity (resolution and scale) emerge as a result of learning in the semiotic system, similar levels emerge in the corresponding cybernetic system. A *cybernetic system of the m-th order* emerges, or *multiscale cybernetics*. The multiscale cybernetic systems can be characterized by multigranular (m-loops) semiosis which invokes a variety of interesting and important phenomena including *reflection* ("reflexia"), self-organization and emergence (usually attributed to the situation of "complexity") and others.

Can we talk about the virtual equivalence of semiotic and cybernetic systems just by considering a single level loop? We can but the powerful concepts of the semiotic-cybernetic scientific paradigm will be wasted. We do not need the tools and techniques of either in a single loop case. On the other hand, if learning is involved, if planning is of interest, if processes of self-organization and self-description are of significance, no single loop (single level) discussion can be productive: such a simplification will have hidden mistakes.

The joint semiotic-cybernetic paradigm allows us to address all these issues and explore the research developments implied, and the applications of the expected theoretical results.

People have always been respectful to and comfortable with activities related to knowledge acquisition and organization, all of them starting from broad-minded Aristotle and ending with narrowly trained professionals of the Twentieth Century. Problems related to knowledge emerged when we entered the era of intelligent systems:

a) we realized that within a single problem we should address modeling of the system at several levels of resolution (granularity and scale), and
b) we started analyzing processes of self-reflection, when, in addition to the world produced by sensations, we encountered a world produced by our own representations, including representation of ourselves.

A long time ago people discovered that intelligent systems and learning processes depend on architectures of sign-symbol processing. These architectures determine how intelligent systems perceive the world, recognize objects in it and interpret the results of recognition for the subsequent actions. The multigranular architectures of our intelligence and the multigranular representations generated by our intelligence are affected by the processes of single and multi-level self-reflection.

Architectures of sign processing affect the ways intelligent systems behave in the world. They depend on the way these systems *think they behave.* Careful analysis demonstrates that all our knowledge depends on our self-reflection. Our own brain-architectures are reflected in all the knowledge we acquire, even when we think that we analyze an electron, a spray casting, or a bacterium. All our representations reflect the architecture of our brain. Architectures of intelligent systems incorporate the recursion of self-reflection which becomes crucially important for describing interactions among multiple intelligent systems.

Cybernetics was a step in learning *how to know*. We have discovered the phenomenon of self-organization via planning and error compensation during functioning. Self-organization was a step toward self-reflection. With realization of the phenomenon of self-reflection we started paying more attention to the techniques of interpretation. The results of our interpretation are strongly affected by our "self" hidden in the techniques of our intelligence. Then, the cybernetics of the second order emerged (this term was introduced by H. von Foerster to describe the level produced by self-reflection).

In intelligent systems *knowing* always presumes *changing resolution* or *granularity* or *scale* (which is the same). Therefore, learning brings on changing the scale of representation and subsequent changes in processes of decision making, planning, and error compensation within this scale of representation. Each next step of learning leads to the generation of a next order of cybernetic analysis. Once a higher level (level of coarser granularity) is achieved, all previously known (finer resolution) subsystems are subsumed by (aggregated within the model of) the level of coarser granularity.

Various disciplines, including knowledge engineering, artificial intelligence, intelligent control, and semiotics, are stages in the exciting search within and traveling toward multiresolutional cybernetics, or cybernetics of the m-th order. Such systems produce representations in multiple scales, supplement control with self-organization and throw us into a totally new world, a multigranular world, in which we always live even though we do not pay too much attention to its multiresolutional nature.

Various artifacts of life and technology should be discussed from the point of view of multiscale cybernetics. In engineering problems and poetry, scientific research and visual arts, everywhere we will continue to discover the multiresolutional world of semiotic-cybernetic models.

Conference Web Site

The latest information on the conference will be posted on the World Wide Web at: **http://isd.cme.nist.gov/proj/semiotics97/**.

Preliminary Agenda

Monday, September 22: Tutorials

Three parallel tutorials will be offered at NIST on Monday, September 22, the day preceding the opening of the conference. There is a separate registration fee of **$170** per person to attend the tutorials. Please refer to the "Registration" section of this brochure for further information.

TUTORIAL 1: SEMIOTICS
Tutorial organizer - Thomas A. Sebeok (Indiana University, USA)

Eight prominent specialists in various areas of contemporary semiotics will offer briefings on as many domains of the field, selected because of their pertinence to the learning perspectives to be emphasized at the ensuing conference. The program was organized by Thomas A. SEBEOK (Indiana University), who will also preside over and conduct the audience discussions following every presentation.

Papers will be available in advance at the site. After the conference they will be published as a separate volume with a full record of the day's discussions.

The speakers are listed below, with a brief designation of the topic each will cover.

James ALBUS (NIST) and **AlexanderMEYSTEL** (Drexel University & NIST): Semiotics and the Engineering Sciences
Marcel DANESI (University of Toronto): Semiotics and Education
Floyd MERRELL (Purdue University): Semiotics and the Physical Sciences
Richard J. PARMENTIER (Brandeis University): Semiotics and the Social Sciences
Burghard B. RIEGER (University of Trier): Semiotics and Computation
Thomas A. SEBEOK (Indiana University): Semiotics and the Biological Sciences
Jean UMIKER-SEBEOK (Indiana University): Semiotics and the Information Sciences
W.S. WATT (University of California, Irvine): Semiotics and the Cognitive Sciences

TUTORIAL 2: NIST-RCS-Intelligent Reference Control System Architecture
Tutorial organizer - Fred Proctor (NIST,USA)

This tutorial is an introduction to RCS Software which has been transferred from NIST to a number of universities involved in the exploration of intelligent systems. The tutorial covers the NIST Real-time Control System (RCS) reference model architecture and methodology for building intelligent controllers. RCS has been applied to manufacturing, land and submarine vehicle control, general mail handling facilities, and to many other control problems characterized by a hierarchy of tasks in sensor-rich environments. Topics include:

1. Fundamentals of RCS
2. Problem Analysis
3. Controller Design
4. Implementation Issues
5. Examples
6. Software Support for RCS

Presenter:

James S. Albus is Chief of the Intelligent Systems Division at NIST. Dr. Albus has been involved in the study of intelligent systems for twenty-five years. During that time, he designed and managed the development of a number of intelligent systems. He was co-developer of the RCS architecture and received several awards for his work in control theory.
Frederick M. Proctor is Group Leader of the Control Systems Group at NIST. He received a B.S in Electrical Engineering from the University of Maryland in 1986, and an M.S. in Computer Science from the Johns Hopkins University in 1993. He has implemented controllers for robots, machine tools, and coordinate measuring machines, and is responsible for RCS software support.
Anthony Barbera is the Director for Controller Development at the Advanced Technology and Research Corporation (ATR), in Burtonsville, Maryland. Dr. Barbera was co-developer of the RCS architecture while at NIST, and has built intelligent controllers for military and commercial customers while at ATR and the Martin Marietta Corporation.
Kevin M. Passino received his M.S. and Ph.D in Electrical Engineering from the University of Notre Dame in 1985 and 1989 respectively and his B.S.E.E. from Tri-State University in 1983. He has worked in the control systems group at Magnavox Electronic Systems Co., Ft. Wayne Indiana, on research in missile control and at

McDonnell Aircraft Co., St. Louis Missouri, on research in flight control. He spent a year at Notre Dame as a Visiting Assistant Professor before coming to the Dept. of Electrical Engineering at The Ohio State University in 1990 as an Assistant Professor. He has been an Associate Professor at Ohio State since 1995.

TUTORIAL 3: Hierarchical Modeling and Understanding via Algebraic Automata Theory

Tutorial organizer - Chrystopher Nehaniv (U. Aizu, Japan)

This tutorial provides an intense introduction to techniques and viewpoints of algebraic automata theory and its relation to formal models of understanding. Loop-free hierarchical coordinate systems for understanding arbitrary finite automata will be motivated by examples from intellectual history (the decimal expansion, clocks, conservation laws in physics, object-orientation) and some simple toy examples.

The mathematical methods of automata theory guarantee the existence and show how to construct such coordinate systems for understanding all finite-state systems. Automation of the construction and the manipulation of such formal models of understanding and the notion of analogy will also be discussed.

Prerequisites: Some level of mathematical maturity. Familiarity with electrical engineering, abstract algebra, or the mathematics of dynamical systems, (esp. transformation semigroups and groups) will be extremely helpful. Participants should have at least some idea about the meaning of the word "homomorphism" and "finite automaton".

DAY 1, Tuesday, September 23: Conference

Conference Opening Session
Time: 8:30am - 9am
Place: Green Auditorium
Introductory Remarks: J. Albus
A. Meystel

Plenary #1 *Introduction in Quantum Theory of Open Systems*
Time: 9am - 10am
Place: Green Auditorium
Speaker: *Y. Kilmontovich*

TRACK 1:
Workshop 1.1: *Semiotic Modeling of Open Systems*
Time: 10am - 12:45pm
Place: Lecture Room A
Organizers: *J. Goguen, U. of California at San Diego*
A. Meystel, NIST/Drexel U.
A. Mironov, Mocow State U.
*F.Y. Wang, U. of Arizona**
P. Werbos, NSF

- Learning in Open Systems
- Theory of Semiotic Modeling
- Scale, Granularity, and Multiresolutional Systems and Methods
- Algebraic Modeling for Semiotics
- Symbol Grounding Methodology
- Intelligent Agents as Semiotic Entities
- Brain Modeling
- Semiotic Models Design Using Genetic Algorithm
- Semiotic Modeling Software
- Artificial Neural Network for Semiotics Modeling

Workshop 1.2 *Semiotic Methods of Information and Knowledge Processing*
Time: 2:45pm - 5:30pm
Place: Lecture Room A
Organizers: *A. Chikrii, Institute of Cybernetics, Ukraine*
M. Herman, NIST
C. Joslyn, Los Alamos National Laboratory
P. Wang, Duke U.

- Interpretations of Cybernetic Models in Semiotics
- Semiosis Loop and Intelligent System Architecture
- How to Close the Semiosis Loop
- Learning How to Perceive
- Sensor Fusion and Data Fusion
- Rough Set Theory and Symbolic Systems
- Theory of Situation Analysi
- Situational Controller Design
- Methodology of Game Theory
- Softcomputing in Situation Controller Design
- Computing With Words

TRACK 2:

Workshop 2.1 *Knowledge Representation in Intelligent Systems*
Time: 10am - 12:45pm
Place: Lecture Room B
Organizers: *L. Kohout, Florida State U.**
C. Landauer, Aerospace Corp.
V. Lefebvre, U. of California at Irvine
E. Messina, NIST
B. Mirkin, DIMACS
G.S. Tseytin, St. Petersburg State U., Russia

- Learning to Represent Knowledge
- Semiotic Models of Knowledge Representation
- Grouping, Focusing Attention, and Combinatorial Search
- Clustering and Classification
- Fuzzy Clustering and Symbol Formation
- Classification as a Tool of Intelligence
- Natural Language Based Knowledge Representation: Dealing With Texts
- Representing Knowledge With Phenomenon of "Reflection" ("Reflexia")
- Knowledge Base Design Using Fuzzy Methodology
- Languages for Situation Analysis
- Uncertainty Modeling in Semiotic Systems
- Knowledge Aggregation and Disaggregation

Workshop 2.2 *Plausible Reasoning and Argumentation as a tool for Machine Learning and Concept Formation in Intelligent Systems*
Time: 2:45pm - 5:30pm
Place: Lecture Room B
Organizers: *V. K. Finn, NINITI, Russia**
M. Kokar, Northeastern U.
L. Kohout, Florida State U.
J. C. A. van der Lubbe, Delft U. of Technology

- Machine Learning and Concept Formation
- Architecture of the Systems of Machine Learning
- JSM-Classification and Reasoning
- Syntactics: Models of Reasoning
- Reasoning as a Component of Learning Process
- Processes of Inference in Natural and Artificial Intelligent Systems
- Theories and Techniques of Reasoning
- Alternative Logical Systems
- Multiresolutional Symbol Grounding
- Consistent Data Analysis and Signal Processing
- Semantics: Semiotics and A Process of Meaning Extraction
- Pragmatics: Symbol Grounding: Construction Linkages "Real World-Model"

TRACK 3:

Workshop 3.1 *Architectures of Intelligent Systems*
Time: 10am - 12:45pm
Place: Lecture Room D
Organizers: *J. Albus, NIST*
B. Gaines, U. of Calgary, Canada
J. Gray, U. of Salford, Great Britain
A. Meystel, NIST/Drexel U.
C. Nehaniv, U. of Aizu, Japan
M. Sulkoski, NGIS

*M. Ulieru, Simon Fraser U., Canada**

• Learning and Self-Organization
• Semiotics & Complexity Theory
• Complexity of Intelligent Semiotic Systems
• When The Complexity Should be Curbed and When Instigated?
• Brain Architectures
• Semiotics: Theoretical Issues of the Architecture of Intelligence
• Hierarchies: of Holons, of Objects, of Agents, of Functional Loops
• Multiagent Architectures
• Hybrid Multiresolutional Control Systems

Workshop 3.2 *Multiresolutional Methods*
Time: 2:45pm - 5:30pm
Place: Lecture Room D
Organizers: *A. Meystel, NIST/Drexel U.*
V. Kreinovich, U. of Texas at El Paso
M. Modarres, U. of Maryland, USA
*I. Muchnik, Rutgers U., Moscow State U.**
U. Ozguner, OSU
F. Zhao, Ohio State U.

• Multiresolutional Essence of Learning
• Theory of Multiresolutional Symbol Processing
• Multiresolutional Knowledge Representation
• Multiresolutional Programming Languages
• Techniques Applied in the Multiresolutional Symbolic Systems
• Multiresolutional Natural Phenomena
• Multiresolutional Systems and Complexity
• Multiresolutional Discrete Event Systems
• Multiresolutional Optimization

TRACK 4:
Workshop 4.1 *Likelihood, Mixtures, and Symbols*
Time: 10am - 12:45pm
Place: Employee's Lounge
Organizers: *R. Streit, Naval Undersea Warfare Center*
*L. Perlovsky, Nichols Research Corporation**
E. Manolakos, Northeastern U.
P. M. Baggenstoss, Naval Undersea Warfare Center

• Similarity Between the Model and the World
• Mixtures and Maximum Likelihood Learning
• Soft Decision Models
• Learning: Parameters and Structures
• Statistical Aspects of Symbols

Workshop 4.2 *Semiotics for Open Systems and Programs*

Time: 2:45pm - 5:30pm
Place: Employee's Lounge
Organizer: *D. Howland, Battelle*
W. Cunningham, TRADOC
B. Onaral, Drexel U.
J. Weiss, EPRI

• Open Systems in Reality
• Semiotics of Battlefield
• Functioning of Power System
• Functioning of a Biological System
• Health Care Programs

TRACK 5:
Workshop 5.1 *Applications I:*
Toward Multidisciplinary Processes in Science and Technology
Time: 10am - 12:45pm
Place: Green Auditorium
Organizers: *Y. Klimontovich, Moscow State U.*
*L. Perlovsky, Nichols Research Corporation**
V. Protopopescu, ONRL
T. Sebeok, U. of Indiana

• Physics of Open Systems
• Cyberaesthetics
• Semiotics in Natural Sciences
• Semiotics and Emergence in Living Systems

• Biosemiotics
• Medical Semiotics and Biomedical Applications

Workshop 5.2 *Applications II: Toward Intelligent Decision Support Systems*
Time: 2:45pm - 5:30pm
Place: Green Auditorium
Organizers: *K. Bellman, DARPA*
P. Borne, Ecole Centrale de Lille
B. Bouchon-Meunier, U. P. E. M. Curie
A. Guez, Drexel U.
*B. Turksen, U. of Toronto**
P. Wang, Duke U.

• Semiotics and Decision Support Systems
• Learning to Make Decisions
• Financial Engineering and Forecasting
• Semiotics for Social, Economic, Humanity Research
• Constructing Systems for Semiotics Education
• Large Scale Semiotic Models

Plenary #2 *Optimizing Evolutionary Computation*
Time: 1:45pm - 2:45pm
Place: Green Auditorium
Speaker: *L. Fogel*

Social Event: *Reception and Cash bar*
Time: 6:30pm - 8:30pm
Place: Holiday Inn Hotel

DAY 2, Wednesday, September 24: Conference

Plenary #3 *Ordinal Optimization*
Time: 9am - 10am
Place: Green Auditorium
Speaker: *Y.C. Ho*

TRACK 1:
Workshop 1.3 *Inductive Semiotic Systems*
Time: 10am - 12:45pm
Place: Lecture Room A
Organizers: *L. Goldfarb, U. of New Brunswick, Canada*
*L. Pervovsky, Nichols Research Corporation**
G. Ritter, U. of Florida
A. Stoica, JPL

• Inductive Learning
• Emergence of New Signs
• Networks of Semiosis

TRACK 2:
Workshop 2.3 *Semiotics, Text Analysis and Education*
Time: 10am - 12:45am
Place: Lecture Room B
Organizers: *V. Dmitriev, Oklahoma State U.*
*L. Perlovsky, Nichols Research Corporation**
L. Odier, NASA
K. Filips-Juswigg, U. of Wisconsin
I. Savelev, NASA
V. Ivanov, UCLA

• Cyberaesthetics and Dynamics of Symbol
• Being and Text
• Computing in Language Education
• Real Space of the Text
• Speech and Language Inside Spaceship
• Neurosemiotics and Artificial Intelligence

TRACK 3:
Workshop 3.3 *Ordinal Optimization*
Time: 10am - 12:45pm
Place: Lecture Room D
Organizers: *Y. C. Ho, Harvard U.*
L.Y. Dai, Washington U.
C.H. Chen, U. of Pennsylvania

J. E. Wieseltheir, Naval Research Laboratory
Ed. Lau, Harvard U.
C. Cassandras, Boston U.
C. G. Panayiotou, U. of Massachusetts

• Techniques for Ordinal Optimization
• Optimal Computing for Discrete-Event Dynamic Systems
• Comparison of Performance Orders of Different DES Designs
• Combinatorially Hard Problems
• Selection Schemes in Ordinal Optimization

TRACK 4:

Workshop 4.3 *S-Cubed-I: Semiotics, Swarms, Super-Turing Computation, and Intelligence*
Time: 10am - 12:45pm
Place: Employee's Lounge
Organizers: *B. J. Copeland, U. Canterbury, New Zealand*
J. Hoffmeyer, U. Copenhagen, Denmark
*J. Mills, Indiana U.**
J. Umiker-Sebeok, Indiana U.

• Swarm Intelligence
• Collective Semiosis
• Emergence of New Behaviors
• Prediction and Control of Swarm Behavior
• Massively Parallel Hybrid (Digital/Continuous) Computational Processes

TRACK 5:

Workshop 5.3 *Applications III: Towards Autonomous Intelligent Systems*
Time: 10am - 12:45am
Place: Lecture Room C
Organizers: *S. Bussman, Daimler Benz Research, Germany*
E. Dickmanns, U. of Bundeswehr
*M. Herman, NIST**
A. Jones, NIST
G. T. McKee, U. of Reading
D. Norrie, University of Calgary, Canada
P. Schenker, JPL
M. Ulieru, Simon Fraser U., Canada

• Learning as a part of Autonomy
• Multi-agent Systems for Manufacturing
• Applications in Process Industry and Production Planning
• Robosemiotics
• Semiotic essence of the phenomenon of Autonomy
• Autonomy in Living Systems
• Autonomous Mobile Robots

TRACK 6:

Workshop 6.3 *Evolutionary Computation*
Time: 10am - 12:45pm
Place: Green Auditorium
Organizers: *D. Fogel, Natural Selection*
TBA

• Various Approaches to Genetic Mechanisms in Learning
• Algorithms Applicable at Different Scales of Evolution
• Evolutionary Development of New Species in Biology and Engineering
• Neural and Neuromorphic Evolutionary Tools and Systems

Plenary #4 *Why Now Semiotics? From Real-Time Control to the Science of Signs and Symbols*
Time: 2pm - 3pm
Place: Green Auditorium
Speaker: *J. Albus*

General Discussion I : *Learning in Intelligent Systems: Semiotics in Action*
Time: 3pm - 5:15pm
Place: Green Auditorium
Organizers: *A. Meystel, Drexel U., NIST*
T. Sebeok, Indiana U.
J. Fetzer, Duluth U.
D. Pospelov, Russian Academy of Sciences
K. Baev, Barrow Neurological Institute

• Testing the Learning Intelligence
• Cybernetics of the m-th Order
• Learning Architectures of the Higher Nervous System
• Biosemiosis: Learning on a Large Scale
• Learning within Large Engineering Systems

Social Event: *Banquet and Cash bar*
Time: 6:30pm - 9pm
Place: Holiday Inn Hotel
Speaker: A. Meystel - *Multiresolutional Matters of The Mind*

DAY 3, Thursday, September 25: Discussions

General Discussion II: *The Key Phenomena of Intelligence*
Time: 8:30am - 10:30am
Place: Green Auditorium
Organizers: *S. Barber, U. of Texas*
M. Herman, NIST
S. Lee, U. of So. California, USA
*L. Perlovsky, NRC**
H. Szu, U. of SW Louisiana

• Evolution of the Phenomenon of Intelligence
• Learning and Intelligence: How Are They Related to Each Other?
• Pattern Recognition and Image Processing
• Measurement of Intelligence: Semiotic Tools
• Forming Decisions
• Phenomena of Discovery
• A System's Intelligence Quotient (SIQ)
• Semiosis and Recognition
• Extraction of Meaning from Knowledge Carriers

Tour 1: NIST Intelligent Systems Division Lab Tour
Time: 8:30am - 10:30am
Place: Shops Building (304) Conference Room B106
Organizers: *R. Quintero, NIST*

Tour 2: NIST Autonomous Vehicle Tour
Time: 10:45am - 12:45pm
Place: Shops Building (304) Conference Room B106
Organizers: *M. Juberts, NIST*

General Discussion III: *Evolution of Semiotic Systems*
Time: 10:45am - 12:45pm
Place: Green Auditorium
Organizers: *J. L. R. Chandler, WESS*
*D. Fogel, Natural Selection**
A. Meystel, NIST/Drexel U.
C. Nehaniv, U. of Aizu, Japan

• Learning as the Nature of Semiosis
• Induction and Generalization
• Learning and Evolution of Life, Science, and Technology
• Genetic Algorithms and Evolutionary Computing
• Self-organization of Symbolic Systems
• Learning in Situation Analysis
• Neural-Fuzzy Systems and Learning

Plenary #5 The Centrality of Information Granulation in Human and Machine Intelligence
Time: 1:45pm - 2:45pm
Place: Green Auditorium
Speaker: *L. Zadeh*

General Discussion IV: *Applying Semiotics to Understand Intelligence*
Time: 2:45pm - 5pm
Place: Green Auditorium
Organizers: *J. Albus, NIST*
S. Petrov, ORNL
*T. Samad, Honeywell**

- Is it possible to understand Intelligence?
- Messages from the "Semiotic Room"
- Multiple Intelligences, Emotional Intelligence and Other Phenomena....
- Is it possible to teach Semiotics?
- What should be done?

Monday, September 22

Time		Tutorial 1 *Lecture Room A*	Tutorial 2 *Lecture Room B*	Tutorial 3 *Lecture Room D*
8:30 AM		Registration		
9:30 AM - 12:45 PM	*1	Semiotics	The NIST Real-time Control System (RCS) Architecture Model and Software Engineering	Hierarchical Modeling and Understanding via Algebraic Automata Theory
12:45 PM - 2:00 PM		Lunch - **NIST Cafeteria** (Use the special line reserved for ISAS'97 Tutorial participants)		
2:00 PM - 5:15 PM	*2	Semiotics	The NIST Real-time Control System (RCS) Architecture Model and Software Engineering	Hierarchical Modeling and Understanding via Algebraic Automata Theory
6:00 PM - 8:00 PM		Conference Registration at the **Holiday Inn Hotel**		

11:00 AM - 11:20 AM *1 Morning Coffee Break - **NIST Cafeteria** (Use the special line reserved for ISAS'97 participants)
3:30 PM - 3:50 PM *2 Afternoon Coffee Break - **NIST Cafeteria** (Use the special line reserved for ISAS'97 participants)

Day 1 — Tuesday, September 23

Time		Track 1 *Lecture Room A*	Track 2 *Lecture Room B*	Track 3 *Lecture Room D*	Track 4 *Employee's Lounge*	Track 5 *Green Auditorium*	Track 6
8:00 AM		Registration					
8:30 AM - 9:00 AM		*Opening Session - **Green Auditorium***					
9:00 AM - 10:00 AM		*Plenary #1 - **Green Auditorium** - V. Kilmontovich, Introduction to Quantum Theory of Open Systems*					
10:00 AM - 12:45 PM	*1	1.1 Semiotic Modeling of Open Systems	2.1 Knowledge Representation in Intelligent Systems	3.1 Architectures of Intelligent Systems	4.1 Likelihood Mixtures and Symbols	5.1 Applications I: Toward Multidisciplinary Processes in Science and Technology	
12:45 PM - 1:45 PM		Lunch - **NIST Cafeteria** (Use the special line reserved for ISAS'97 participants)					
1:45 PM - 2:45 PM		*Plenary #2 - **Green Auditorium** - L. Fogel, Optimizing Evolutionary Computation*					
2:45 PM - 5:30 PM	*2	1.2 Semiotic Methods of Knowledge Processing	2.2 Plausible Reasoning in Machine Learning	3.2 Multiresolutional Methods	4.2 Semiotics for Open Systems and Programs	5.2 Applications II: Toward Intelligent Decision Support Systems	
6:30 PM - 8:30 PM		*Cash bar & Reception - **Holiday Inn Hotel***					

*** The **Poster Session** is in the **Display Area** each day in parallel with all sessions

10:30 AM - 10:45 AM *1 Morning Coffee Break - **NIST Cafeteria** (Use the special line reserved for ISAS'97 participants)
3:30 PM - 3:45 PM *2 Afternoon Coffee Break - **NIST Cafeteria** (Use the special line reserved for ISAS'97 participants)

Day 2 — Wednesday, September 24

Time		Track 1 *Lecture Room A*	Track 2 *Lecture Room B*	Track 3 *Lecture Room D*	Track 4 *Employee's Lounge*	Track 5 *Lecture Room C*	Track 6 *Green Auditorium*
8:00 AM		Registration					
9:00 AM - 10:00 AM		*Plenary #3 - **Green Auditorium** - V. C. Ho, Ordinal Optimization*					
10:00 AM - 12:45 PM	*1	1.3 Inductive Semiotic Systems	2.3 Semiotics, Text Analysis, and Education	3.3 Ordinal Optimization in Intelligent Systems	4.3 S-Cubed-I: Semiotics, Swarms, Super-Turing Computation, and Intelligence	5.3 Applications III: Towards Autonomous Intelligent Machines	6.3 Evolutionary Computing
12:45 PM - 2:00 PM		Lunch - **NIST Cafeteria** (Use the special line reserved for ISAS'97 participants)					
2:00 PM - 3:00 PM		*Plenary #4 - **Green Auditorium** - J. Albus, Why Now Semiotics? From Real-Time Control to the Science of Signs and Symbols*					
3:00 PM - 5:15 PM	*2	General Discussion I - **Green Auditorium** - Learning in Intelligent Systems: Semiosis in Action					
6:30 PM - 9:00 PM		*Cash bar & Banquet - **Holiday Inn Hotel** - A. Meystel, Multiresolutional Matters of The Mind*					

*** The **Poster Session** is in the **Display Area** each day in parallel with all sessions

11:00 AM - 11:15 AM *1 Morning Coffee Break - **NIST Cafeteria** (Use the special line reserved for ISAS'97 participants)
3:30 PM - 3:45 PM *2 Afternoon Coffee Break - **NIST Cafeteria** (Use the special line reserved for ISAS'97 participants)

Day 3 — Thursday, September 25

Time		All Tracks *Green Auditorium*	Tours *Shops Bldg. 304/B106*
8:00 AM		Registration	
8:30 AM - 10:30 AM		General Discussion II - The Key Phenomena of Intelligence	*NIST ISD Lab Tours*
10:30 AM - 10:45 AM		Morning Coffee Break - **NIST Cafeteria** (Use the special line reserved for ISAS'97 participants)	
10:45 AM - 12:45 PM		General Discussion III - Evolution of Semiotic Systems	*NIST Autonomous Vehicle Tour*
12:45 PM - 1:45 PM		Lunch - **NIST Cafeteria** (Use the special line reserved for ISAS'97 participants)	
1:45 PM - 2:45 PM		*Plenary Session #5 - **Green Auditorium** - L. Zadeh, Centrality of Information Granulation in Human and Machine Intelligence*	
2:45 PM - 5:00 PM	*	General Discussion IV - Applying Semiotics to Understand Intelligence	
5:00 PM - 5:30 PM		*Workshop Concluding Session - **Green Auditorium***	

*** The **Poster Session** is in the **Display Area** each day in parallel with all sessions

3:30 PM - 3:45 PM * Afternoon Coffee Break - **NIST Cafeteria** (Use the special line reserved for ISAS'97 participants)

Poster Session

A poster session will be held each day of the conference in the display area outside the Green Auditorium.

Location

The National Institute of Standards and Technology is located in Gaithersburg, Maryland, approximately 20 miles northwest of Washington, D.C. The conference will be held in the NIST Administration Building (101), Green Auditorium.

Registration

The three day conference (September 23 - 25) registration fee is **$315** per person and includes conference materials, proceedings, coffee breaks, lunches, a reception, and banquet. The student registration fee of **$85** per person includes conference materials, proceedings, coffee breaks, and lunches. The tutorial registation fee is **$170** per person and includes tutorial materials, lunch, and coffee breaks. Tutorial sessions will be held at NIST on Monday, September 22. The fee is **$485** to register for **both** the conference and a tutorial. To register, please complete the appropriate registration card and send it with payment to NIST, Office of the Comptroller, A807 Administration Building, Gaithersburg, MD 20899-0001 USA or fax it to Lori Phillips (301) 948-2067 (see registration card). For your name to appear on the preliminary participants' list, registrations for both the conference and the tutorial must be received no later than **Monday, September 1, 1997**. Requests for refund or cancellation (for both events) must also be received, in writing, by **Monday, September 1, 1997.**

Accommodations

A block of rooms has been reserved at the Gaithersburg Holiday Inn, (301) 948-8900, at a special rate of $80, single or double, and at the EconoLodge, (301) 963-3840, at a special rate of $45, single or double. Please add 12% tax to these rates. To register for a room, please call the hotel of your choice directly no later than **Monday, September 1, 1997**. After that date, the rooms will be released for general sale at the prevailing rates of the hotel.

Coffee Breaks and Lunch

Refreshments will be provided during breaks. Lunch will be provided for both the tutorial and conference attendees each day.

Social Events

To provide an opportunity for informal interaction, a cash-bar reception with hors d'oeuvres will be held on Tuesday, September 23, at the Gaithersburg Holiday Inn. A banquet will be held on Wednesday, September 24, at the Gaithersburg Holiday Inn. The banquet speaker will be Alex Meystel, NIST, Drexel University. Additional banquet tickets are available at **$35** each.

Transportation

BWI Super Shuttle, **(301) 369-0009**, offers commercial van service from Baltimore-Washington International Airport to the Gaithersburg area. Call for reservations. Crystal Airport Shuttle, **1-800-872-2797**, is available from Dulles International and Washington National Airports to Gaithersburg. The cost is $19 - $30 one-way.

The Washington Metro has subway service to Gaithersburg. The Metro System can be boarded at Washington National Airport. Take the Yellow Line train marked “Mount Vernon Square” to Gallery Place and transfer to the Red Line train marked “Shady Grove” to the Shady Grove station in Gaithersburg. Service is every 6 to 15 minutes depending on the time of day. Travel time from National Airport to Shady Grove is approximately 50 minutes. Taxis are available from the Shady Grove Metro station to area hotels.

A NIST shuttle van operates for official visitors from the Shady Grove metro station to NIST on weekdays. The van leaves the Shady Grove station on the quarter and three-quarter hour (e.g. 8:15, 8:45,. . .4:45, 5:15) from the east side parking lot.

Roundtrip bus transportation will be provided between the conference hotels and NIST each day.

Registration Contact

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NIST
Bldg. 101, Rm. B116
Gaithersburg, Md. 20899-0001
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Fax: (301) 948-2067
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Technical Contacts

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Intelligent Systems and Semiotics '97:
A Learning Perspective
September 22 - 25, 1997
Registration Card

Last Name_____
First Name_____
Organization_____
Street Address_____
Rm. No./Mail Code_____
City, State, Zip_____
Business Telephone_____
Fax No/email_____
Special Assistance _____

Form of Payment:
◊ Check enclosed made payable to: NIST/ISAS 97.
(Checks from outside the United States must be written on a US bank.)

◊ Master Card _____Exp. _____

◊ Visa Card _____Exp. _____

◊ Discover _____ Exp. _____

◊ Authorized Signature _____

◊ Purchase order/Training form enclosed
(Faxed copy unacceptable; provide one on-site at registration.)

Intelligent Systems and Semiotics '97:
A Learning Perspective
September 22 - 25, 1997
Registration Card (Continued)

I will attend:

◊ **Tutorial Fee** $170 _____

Please indicate which tutorial you plan to attend (choose only 1)
◊ Tutorial on Semiotics
◊ NIST Real-Time Control Systems Architecture (RCS)
◊ Hierarchical Modeling via Algebraic Automata Theory

◊ **Conference Fee**
◊ Regular Fee $315 _____
◊ Student Fee $85 _____

◊ **Additional Banquet Tickets**
No. of tickets____ x $35 each _____

Total Payment _____

Please return this form by **Monday, September 1, 1997** to:

Office of the Comptroller
National Institute of Standards and Technology
A807 Administration Building
Gaithersburg, MD 20899-0001 USA

Or Fax/Email to: Lori Phillips
(301) 948-2067/lori.phillips@nist.gov

REQUESTS FOR CANCELLATION & REFUND MUST BE RECEIVED IN WRITING, BY SEPTEMBER 1, 1997

Please return this form by September 1, 1997 to:
Office of the Comptroller
A807 Administration Bldg.
National Institute of Standards and Technology
Gaithersburg, Md. 20899-0001 USA

or

Fax to:
Lori Phillips
(301) 948-2067

Driving Instructions

To reach NIST:
Traveling north on I-270: take Exit 10, Rt. 117 West, Clopper Road. At the first light on Clopper Road, turn left onto the NIST grounds.

Traveling south on I-270: take Exit 11B, Rt. 124 West, Quince Orchard Road. At the second light turn left onto Clopper Road. At the next light, turn right onto the NIST grounds.

To reach the Administration Building, turn left after passing the guard office. Signs will direct you to visitor parking.

To reach the Gaithersburg EconoLodge:
On northbound I-270: take I-495 to I-270 north to Exit 11, Route 124 East, Montgomery Village Avenue. At the second traffic light, turn left onto Route 355 (N. Frederick Avenue). Follow Route 355 for approximately 2.5 miles. Pass the Flaming Pit Restaurant and take the next right. The hotel is at the top of the hill.

On southbound I-270: take Exit 11A, Montgomery Village Avenue and follow the above directions.

Telephone Number: (301) 963-3840

To reach the Gaithersburg Holiday Inn: From Washington, D.C., on northbound I-270: take Exit 11, Route 124 East, Montgomery Village Avenue. At the second traffic light, turn left onto Route 355 (Frederick Avenue). The hotel will be on the right.

On southbound I-270: take Exit 11A, Montgomery Village Avenue and follow the above directions.

Telephone Number: (301) 948-8900

Maps